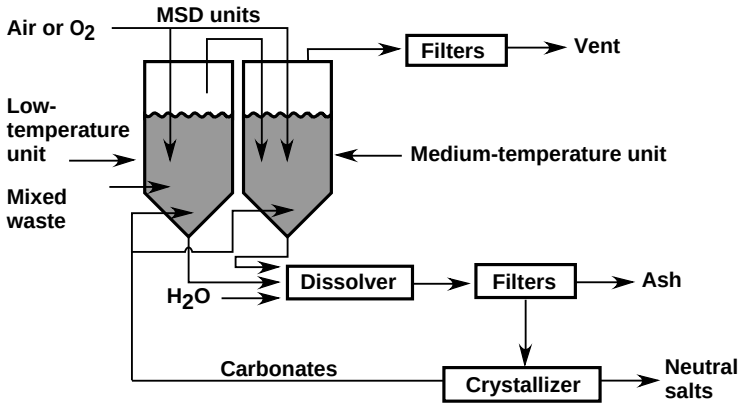
Molten-Salt Destruction of Wastes

Advanced two-stage process is a major advance over incineration

Molten-salt destruction (MSD) offers a clean, effective alternative to incineration for the destruction (by oxidation) of hazardous and mixed wastes, medical wastes, chemical warfare agents, and energetic materials such as explosives, propellants, and pyrotechnics. It is a very stable, controllable technology; provides for *in situ* scrubbing of acid gases and particulates; and involves no site restoration.



Process flow diagram for a two-stage, mixed-waste treatment unit.

How it works and some advantages

In MSD, combustible materials are oxidized in a bath of molten salts (a combination of carbonates, halides, and sulfates of sodium, lithium, potassium, and calcium) at 500 to 950°C. The organic components of the material react with oxygen to produce carbon dioxide, nitrogen, and water. Inorganic components of the waste material, including radioactive materials, form an ash, which is retained in the molten salt. These molten salts, being alkaline, "scrub" any acid gases, such as HCl and HF, produced in the oxidation of halogenated wastes.

APPLICATIONS

- *Hazardous wastes*
- *Mixed wastes*
- *Medical wastes*
- *Chemical warfare agents*
- *Explosives, propellants, and pyrotechnics*

MSD has several advantages over incineration of wastes. For example, MSD does not result in formation of oxides of nitrogen from the high temperatures involved nor are there fugitive emissions of the radioactive materials from mixed wastes. Additionally, permits for the construction and operation of incinerators are difficult to obtain, and public opposition to incinerators can be strong. Open burning or open detonation (OB/OD) of energetic materials is also becoming undesirable because of incomplete combustion and the formation of secondary toxic substances, which can lead to degradation of air, soil, and water. The U.S. Army, which has a substantial need for destruction of energetics, has a self-imposed mandate to ban OB/OD by 1997.

LLNL advances in MSD technology

LLNL must arrange for the safe disposal of several kinds of wastes. In work conducted so far, we have safely destroyed four kinds of high explosives (HMX, RDX, PETN, and TATB) using MSD. In all cases, the explosives were introduced into the system as constituents of oil/water emulsions.

We are demonstrating a two-stage unit for destroying mixed wastes, involving low- and medium-temperature units. Conceptual designs for units to destroy medical wastes have also been prepared.

Availability: This technology is available now. We are seeking industrial partners for the development and commercialization of molten-salt systems specially tailored for each waste stream of interest.

Contact

Ravindra S. (Ravi) Upadhye
Phone: (510) 423-1299
Fax: (510) 422-3165
E mail: upadhye@cms2@llnl.gov
Mail code: L-591

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